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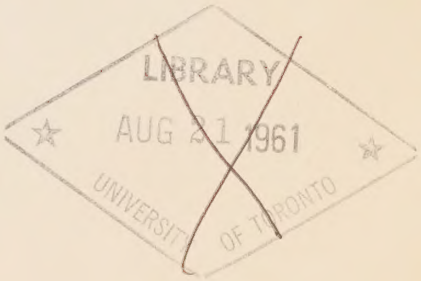
SKILLED MANPOWER

No. 9-A

THE CURRENT STATUS OF ELECTRONIC DATA PROCESSING IN CANADA



Department of Labour, Canada,
in co-operation with federal and
provincial government agencies and
other groups

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Report.

Research Program on the
Training of Skilled Manpower

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Department of Labour, Canada,
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December 1960

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INTRODUCTION

This report is one of a series of studies carried out under the Skilled Manpower Training Research Program initiated by the Federal Department of Labour in 1956, in co-operation with other interested federal and provincial departments and management and union organizations. The research program is under the general direction of the Interdepartmental Skilled Manpower Training Research Committee and its aims and objectives are set out in detail in Report No. 1 of this series, entitled "Progress Report", issued in June 1957.

An important phase of the Skilled Manpower Training Research Program has been the study of technological changes in selected industries and their effects on manpower and training requirements. In this phase of the program, the Committee has been greatly assisted by the tripartite Advisory Committee on Technological Change, which was set up in 1957.

In the summer of 1958 a decision was taken to explore the area of office mechanization and automation. Accordingly, a case study was initiated on the impact of the introduction of electronic data processing (EDP) on a large Canadian office organization. A final report on this study must await the completion of conversion to the new system, and will, therefore, not likely be available, at the earliest, until 1962. An interim report dealing with the new occupations created by EDP is planned for 1961.

Meantime it has become clear that a more general assessment of the status of technological change in Canadian offices was advisable, because it will be some time before the case study results will be available and, even then, it would be unwarranted to generalize about the Canadian EDP situation as a whole from the results of a single case. Although the impact of office mechanization in all its forms, and of organizational and systems change, on clerical, white collar, and management occupations is the full area requiring investigation, it was decided to concentrate research resources at the outset on electronic data processing, the most recent but potentially most far-reaching of all the changes that are taking place in office employment. This research was planned in two stages. Stage I involved the administration of a mailed questionnaire to all known Canadian EDP users[1] at January 1, 1960 to

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(1) Unfortunately, information about four EDP installations in operation at January 1, 1960 came to our attention too late for inclusion in this survey. The installations are:

Standard Telephones and Cables, STANTEC ZEBRA, Defence Research Board, Suffield Experimental Station, Ralston, Alberta.
Standard Telephones and Cables, STANTEC ZEBRA, Standard Telephones and Cables Manufacturing Ltd., 9600 St. Lawrence Blvd., Montreal, Quebec.
National Cash Register NCR 102-A, Royal Canadian Air Force, Cold Lake, Alberta.
National Cash Register NCR 102-A, A. V. Roe Company, Malton, Ontario.

Information on these installations will be included in a subsequent survey.

accumulate factual information on the number and types of computers in use, the types and sizes of organizations utilizing computers, the different kinds of work being done by this equipment, and the number of people employed in the several new occupations created by the new systems and equipment. The questionnaire received a 100 per cent return. The purpose of this report is to present the results of this survey.

Stage II is designed to obtain information on the impact of EDP on employment, training and retraining, job content, clerical job mix, organizational structure and management, transfers, special groups--clerical supervisors, older clerical workers, etc., and on the new EDP occupations. Under consideration also are exploratory studies of: a) the effects of using computers to compile information for management decision-making which was previously not accessible because of cost or because such information compiled by conventional methods would be out of date by the time it could be processed; and b) the changes that take place in a factory when computer control is introduced into manufacturing operations, e.g. the rolling of steel sheet. These data will be collected through field interviews at a sample number of computer-user establishments during the spring and summer of 1961.

This report was prepared by Dr. John C. McDonald, under the direction of Mr. J.P. Francis and the supervision of Mr. P. Cohen of the Economics and Research Branch, Department of Labour. The co-operation and generous assistance received from the representatives of the computer manufacturing and distributing firms and from the officials of the user organizations are gratefully acknowledged.

SUMMARY

1. There were 89 electronic digital computers in operation in Canada at January 1, 1960: Nine large-scale, 60 medium-sized and 20 small. This relatively small number of computers should not obscure the comparatively rapid rate of growth of computer utilization in Canada during the past five years.

2. Seventy-two of the 89 installations were located in the provinces of Ontario and Quebec, with 40 installations located in the two cities of Toronto and Montreal.

3. The 89 computers of all sizes were distributed among 69 different organization at 80 different establishments. As would be expected, the large organizations accounted for proportionally more EDP installations than the smaller organizations.

4. Manufacturing, with 30 EDP installations, had the largest number of computers of any of the major industry groups. Finance, Insurance, however, with 3 large computer installations out of a total of 12 computers, had more computer capacity than any other industry group.

5. The 89 EDP installations accounted for 4,519 hours use (average) per week. Approximately half of these computer hours were devoted to commercial data processing and half to scientific and engineering computations. But, as the smaller computers were being used almost exclusively for scientific work, while most of the large-scale computers were engaged in business-type data processing, approximately 75 per cent of computer capacity was found to be used for commercial data processing.

6. Accounts receivable and customer billing, payroll, inventory control, and budget and cost accounting accounted for approximately 75 per cent of the computer time devoted to commercial data processing applications.

7. Twenty-nine EDP installations made computer time available to 126 outside users for an additional 335 hours (average) per week. This use of computers by other organizations accounted for only about 7 per cent of total computer utilization.

8. EDP has introduced shift working into the traditional nine-to-five world of the office. Seventeen of the 89 computer installations were being operated on the basis of two or more regular shifts.

9. Electronic data processing has created at least 1,216 new full-time jobs. These include administrators and project planners, programmers, computer operators, computer technicians and other personnel such as tape librarians and peripheral equipment operators. More than 75 per cent of the new jobs were found to be filled by men.

10. No attempt has been made in this mailed survey to assess either the actual or potential employment impact of electronic data processing. There were approximately 74,000 office employees in establishments using computers.

Chapter I

Early Electronic Data Processing Developments

This chapter presents a short history of the early development of electronic data processing, particularly with reference to Canada. This historical material may provide a perspective which will assist the reader in interpreting the results of the survey proper. The information on which the account is based was not derived from the survey. This material came from the computer manufacturers and distributors and from a number of individual businessmen and university professors who were associated with EDP in the early years.

During the later years of World War II and in the years immediately following, developmental work in computer technology had begun to swing into high gear in the United States.(1) Much of this early work was directly related to military applications such as aerodynamics, simulating missile trajectories, and so on. The material in this chapter refers to the development of digital computers. Analogue(2) computers are not covered because, since they are used primarily for engineering and scientific work, they have little bearing on clerical occupations and employment.

As well as government departments and defence establishments, some of the universities and private companies played important roles in this development. The International Business Machines Company and Harvard University collaborated on the Harvard Mark I in 1944; Harvard built Mark II for the United States Navy in 1947; and the Bell Telephone Research Laboratories built a series of seven computers, beginning in 1940. These earliest computers tended to use electro-mechanical relays and were used mostly for solving scientific problems.

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(1) During the same period, considerable activity in this field was also taking place in European countries, particularly in the United Kingdom, Germany and the U.S.S.R. The computer history in this chapter, however, has been limited to North America because, except for the early installation of the British designed Ferranti computer at the University of Toronto, the main impact on computer utilization in Canada has come from the United States.

(2) Analogue computer: An electronic calculating machine that uses physical quantities, such as lengths, voltages, or shaft revolutions to represent numerical values that occur in a problem.
Digital computer: A computer that uses digits or yesses and noes, usually expressed in 1's and 0's, to represent variables in a problem.
U.S. Dep't. of Labor. Occupations in Electronic Data Processing. G.P.O. Washington, D.C. January 1959.

It was not until 1946 that the possibility of a general purpose electronic digital computer became a reality. In February of that year the Moore School of Electrical Engineering at the University of Pennsylvania demonstrated the ENIAC computer, and by 1952 had gone on to produce the EDVAC computer. Another main line of computer development was initiated at the Institute for Advanced Study, Princeton University with the IAS computer in 1952. From this line of development sprang ILLIAC (1952) and ORDVAC (1952) at the University of Illinois, AVIDAC and ORACLE (1953) at the Argonne National Laboratory, MANIAC (1952) at Los Alamos, and JOHNNIAC (1954) at the Rand Corporation. A third important area of development centered around the work of the National Bureau of Standards with the production of the SEAC computer in 1950, and of DYSEAC in 1953.

In addition, between 1950 and 1954 developmental work was taking place in a wide variety of government and armed forces establishments, universities and private companies including the Computer Research Corporation (CADAC 102, 102A, CRC 105, 107), IBM (701, 702, 704, 650), Remington-Rand (UNIVAC I, Univac File Computer), General Electric (OARAC), The Raytheon Manufacturing Company (RAYDAC), the Massachusetts Institute of Technology (WHIRLWIND I), Harvard University (Harvard Mark III), the University of California (CALDIC), California Institute of Technology (MINAC), the Monroe Calculating Machine Company (MONROBOT), the Underwood Corporation (ELECOM 100, 120, 200), Burroughs Adding Machine Company, Engineering Research Associates (ERA 1101, 1102, 1103), Marchant (MINIAC), Jacobs Instrument Company, Hogan Laboratories, the Consolidated Engineering Company, and others too numerous to list.

One of the considerations that raised interest and activity in computer development was the potentialities of applying the electronic digital computer to the large-scale data processing problems of business and government. In 1949 J.P. Eckert and J.W. Mauchly had developed the BINAC computer. Building on this work, they developed UNIVAC in 1951. The first installation that proved the feasibility of using this sort of computer to handle large scale data processing problems was the UNIVAC I installation at the United States Bureau of the Census to process the 1950 decennial census returns.

Installations, in the United States, at the Metropolitan Life Insurance Company, the General Electric Company, etc., soon followed and the commercial era of 'the electronic brains' had been launched. In a very few years Sperry-Rand had acquired UNIVAC, the National Cash Register Company had acquired CRC 102A, Burroughs had acquired Electrodata, the International Business Machines Corporation had put large resources into developing and marketing commercial computers, Bendix Aviation had adapted an airborne computer for more general computation, and several other large organizations including Royal-McBee, Philco, Radio Corporation of America, Minneapolis-Honeywell, and General Electric had initiated developmental programs. For the past decade the technology in this field has been highly volatile, with breakthrough following breakthrough in quick succession, and the marketing situation a highly competitive one in which rewards and losses may be equally large.

Meantime, virtually nothing had happened in this field in Canada before 1948. In that year a small group of Canadians came together to found Computing Devices of Canada. In the early years this organization was sustained largely by research and development contracts from the Royal Canadian Navy and the Royal Canadian Air Force. During 1952, CDC acquired the Canadian franchise for a computer called the CRC 102A which had been put on the market by a small California Company, the Computer Research Corporation. The CRC 102A was not a computer designed primarily for commercial data processing. It was a medium-scale computer designed for scientific and engineering applications, but it was a digital computer. In 1953, the Avro Aircraft Company in Malton, Ontario, installed a CRC 102A and became the first stored program computer installation in Canadian industry. Very shortly after this, a second CRC 102A unit was installed by the Canadian Air Force at Cold Lake, Alberta.

At about the same time in 1948, the University of Toronto decided to build a relay-type computer like the Mark I at Harvard but later changed its plan and embarked on the building of a prototype digital computer. This computer was never in fact put into operation because in 1949 a decision was taken to acquire a British designed Ferranti computer. The Ferranti FERUT computer was installed in the early 1950's--the first Canadian computer installation. By 1950 the University had begun on a modest scale to teach computer technology and computer applications to students in engineering, physics and mathematics. By 1951 McGill University had begun offering a computer course in their Extension Department. Later, with the growth of electronic data processing, the Canadian universities generally introduced courses in computer applications and installed systems such as the IBM 650, Royal McBee LGP-30, Bendix G-15 and ALWAC-III for undergraduate and graduate studies.

During the early 1950's another small firm in California, Consolidated Electrodynamics Corporation, had designed and produced the Electrodata computer. The Electrodata Datatron 205 was a digital computer but, once again, was designed primarily for scientific and engineering applications. A small Canadian firm, Data Processing Associates, had been formed in 1954 with a view to building up a consulting business which would include offering advice on computer installations and applications. Data Processing Associates picked up the Canadian franchise for Electrodata and were successful in placing installations at Atomic Energy of Canada, Chalk River, and at Canadair, Montreal, during 1956-57. Later, in 1957, the Burroughs Company acquired Electrodata in the United States and shortly after acquired Data Processing Associates in order to obtain the franchise in Canada. The name of the computer was subsequently changed to the Burroughs computer.

Meantime, the Bendix Aviation Company had acquired an interest in Computing Devices of Canada. Bendix had developed a computer adapted to perform a wide range of applications in the scientific and engineering field. CDC became the logical outlet for the Bendix G-15 computer in Canada. The first Canadian installation was at CDC, Ottawa, in January 1957, followed by a second installation a few months later at the National Research Council, Ottawa.

By 1956 the International Business Machines Corporation was distributing the IBM 650 computer in Canada. In the early months of that year the first installations of this medium-scale digital computer were made in three Canadian insurance companies, and in the following year further installations took place in Canadian government agencies and large manufacturing companies. In January 1957 the first large-scale IBM 705 digital computer installation took place at the Canadian Pacific Railway Company in Montreal. In May of that year, the first large-scale scientific computer in Canada--an IBM 704--was installed at the Avro Aircraft Company. Sperry-Rand installed their first large-scale UNIVAC II computers at the Sun Life Assurance Company, Montreal, London Life Insurance Company, London, and Ontario Hydro Electric Power Commission, Toronto, in 1958. The second IBM 705 system was installed in the same year by the Confederation Life Association in Toronto. Later in 1958 International Business Machines introduced the IBM 305 RAMAC, the first Canadian installation taking place in September 1958.

Summing up, it seems fair to say that practically all the initiative in computer development in this country thus far has come from outside Canada, particularly from the United States. One notable exception concerns the Defence Research Board which did in fact build a prototype computer and is understood to be currently engaged in the development of a computing device featuring high speed storage characteristics. Other projects that should not be overlooked include the special purpose computers being developed by Ferranti-Packard for post office and airline reservation work.

Chapter II

The Current Status of Electronic Data Processing in Canada

There were 89 electronic digital computers[1] in operation in Canada at January 1, 1960.[2]

Table 1 - Number of Computers in Canada by Size, January 1, 1957 to January 1, 1960

Date	Large	Medium/Large[1]	Medium/Small	Small	Total
Up to Jan. 1, 1957..	-	1	6	-	7
Jan. 1, 1958..	1	4	9	4	18
Jan. 1, 1959..	6	14	22	5	47
Jan. 1, 1960..	9	20	40	20	89

(1) The distinction between 'medium/large' and 'medium/small' in this research hinges on the amount and nature of on-line off-line peripheral equipment operated in conjunction with the computer. Hence, for example, a computer designated as medium by virtue of its capacity, speed, and price would be classified as 'medium/small' with punch card input/output only and the same type of machine would be classified as 'medium/large' should it be used with several magnetic tape input units.

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(1) The operational definition of a computer adopted for the purposes of this research includes criteria of capacity, speed, and price but hinges primarily on some form of 'internal memory'. Hence, the smaller 'electronic calculators' with 'external programming' (e.g. wired plug boards) have been excluded.

(2) Cp. It has been estimated that as early as 1958 there were more than 1,000 large computers in operation in the United States. J. Diebold. 'Office Automation: Is Management Getting its Money's Worth?' American Management Association Review. September 1958. p. 14.

There are any number of factors that might be cited to explain the limited extent to which computers had permeated the Canadian economy by that date. There are proportionally fewer giant firms in Canada that feel they can afford the high purchase price (or monthly rental) of the large computers. As clerical salary costs are generally lower in Canada than in the United States, the potential salary savings represented by computers may have less appeal for Canadian customers.(1) The purchase and rental prices of computers to Canadian customers are generally higher because of the tariff policy on computers and computer components.(2) It has also been suggested that the Canadian national character is innately more conservative than the American and less willing to adopt new techniques.

The relatively small number of computers in Canada should not be allowed to obscure the fact that computer utilization grew from fewer than half-a-dozen early installations to a sizable phenomenon in a short four-year period; that the number of computers in operation more than quadrupled in the two-year period between January 1, 1958 and January 1, 1960; or that, if the present rate of extension were to continue over the next decade, EDP could be expected to become a major feature of the office operations in Canadian business, industry and government.

As would be expected, the distribution of EDP in Canada heavily favoured those areas exhibiting the highest concentration of business and industrial activity.

Table 2 - Geographic Distribution of Computers in Canada by Size, January 1, 1960

Region	Large	Medium/Large	Medium/Small	Small	Total
Atlantic...	-	-	-	2	2
Quebec....	2	10	10	2	24
Ontario...	7	10	26	5	48
Prairie...	-	-	2	8	10
Pacific...	-	-	2	3	5
	9	20	40	20	89

(1) Expected salary savings are frequently one of the basic cost justifications for computer acquisition cited in feasibility studies.

(2) Government of Canada. Department of National Revenue. Customs Tariff and Amendments. Queen's Printer. Ottawa. 1960. Item 414C. Computer, main frame, 10 per cent, most favoured nation. Computer, peripheral equipment. Range, 7½ per cent to 22½ per cent, most favoured nation.

This tendency is even more clearly borne out by the fact that almost half of the EDP installations in the country were concentrated in the two cities of Montreal and Toronto, and more than three-quarters of the large computer installations were to be found in these two cities.

Table 2A - Concentration of Computers in Toronto and Montreal, January 1, 1960

Location	Large	Medium/Large	Medium/Small	Small	Total
Toronto.....	5	4	12	1	22
Montreal....	2	6	9	1	18
	7	10	21	2	40

The distribution of computer installations among industry groups showed a heavy representation in manufacturing. The number of installations at universities and the growing number of EDP consultants and commercial service bureaus accounted for the heavy representation in community and business services. Governments, as large data processors, were heavily represented as were financial institutions, particularly insurance companies.(1)

If the relative capacities of the installations are considered rather than the number of computers as such, on the assumption that the capacities of the large:medium:small computers are related on a ratio of 100:10:1, this distribution changes, with Finance, Insurance replacing Manufacturing in first position.

(1) Refer also to Appendix A. Distribution of Computers by Type of Industry, and by Size of Computer in Canada, January 1, 1960 for a more detailed analysis of the sorts of organizations using electronic data processing.

Table 3 - Distribution of Computers by Major Industry Group, and by Size of Computer, in Canada, January 1, 1960

Industry Group	Large	Medium/Large	Medium/Small	Small	Total
Manufacturing.....	1	9	17	3	30
Community and Business Services(1).....	2	4	10	10	26
Public Administration, Defence(2).....	1	4	3	5	13
Finance, Insurance....	3	2	6	1	12
Transportation.....	1	1	2	1	5
Utilities.....	1	-	1	-	2
Trade.....	-	-	1	-	1
	9	20	40	20	89

(1) Community and Business Service: includes universities, hospitals, business services (engineering consultants) and computer service bureaus, both those operated by computer manufacturers and distributors and those operated as individual enterprises.

(2) Public Administration, Defence: includes government departments and agencies at the federal, provincial and municipal levels.

Table 3A - Distribution of Computer Capacity (Weighted), by Major Industry Group, in Canada, January 1, 1960

Industry	Large	Medium	Small	Estimated Weighted Capacity
Finance, Insurance.....	300	80	1	381
Manufacturing.....	100	260	3	363
Community and Business Services..	200	140	10	350
Public Administration, Defence...	100	70	5	175
Transportation.....	100	30	1	131
Utilities.....	100	10	-	110
Trade.....	-	10	-	10

The 89 computers of all sizes that were operating in Canada at January 1, 1960 were distributed among 69 different organizations at 80 different establishments. The term 'organization' is used to refer to a whole enterprise or institution. The term 'establishment' is used to refer to that part of the enterprise or institution in which the computer is located.(1)

Seventy-one of these establishments had only one computer and 9 of the establishments operated 2 computers. Fifty-two of the organizations were single computer organizations; 8 organizations operated 2 computers at 1 establishment; 7 organizations operated 2 computers at different establishments; 1 organization operated 3 computers, 2 at 1 establishment and 1 at another; and 1 organization operated 4 computers at 4 different establishments.

Out of the total of 89 computers in operation, 27 were owned by user organizations and 61 were leased from the computer manufacturer or distributor.

The distribution of computer installations among different sized establishments shows that larger establishments have acquired EDP more frequently than smaller establishments. The 32 large establishments accounted for 40 (45 per cent) of the EDP installations; the 30 medium-size establishments for 31 (35 per cent) installations; and the 18 small establishments for only 18 (20 per cent) installations.

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(1) For the purposes of this survey the definition of 'establishment' contained in the Draft of Revised Standard Industrial Classification Manual, Dominion Bureau of Statistics, Ottawa, 1958 was adopted: 'The establishment is an operating unit having an independent existence in the sense that it contains within itself all the elements needed for the activities carried on. Thus, the establishment is typically a factory, mine, store or similar unit and in most cases it is a separate firm....' Thinking of the establishment as an identifiable physical entity, the establishment at which the computer was located was chosen as the basic unit of analysis. The result has been less than satisfactory for two reasons. First, in many multi-establishment organizations, the role of the computer, especially the large-scale computers, transcends such arbitrary parameters. Second, in many single establishment organizations, the role of the computer, especially the smaller-scale computers, may be limited to one or two departments within the establishment. Looking forward to further research in this area, experimentation is now taking place with the difficult concept of a 'functional' approach to the organizational context of the computer.

Table 4 - Distribution of Computers, by Size of Establishment, and by Size of Computer, in Canada, January 1, 1960

Size of Establishment (Number of Employees)	Number of Establishments in Size Category	Large	Medium/ Large	Medium/ Small	Small	Total
Small Up to 250...	18	2	3	4	9	18
Medium 251-1,500...	30	3	7	16	5	31
Large 1,501 and over.	32	4	10	20	6	40
	80	9	20	40	20	89

However, as can be seen from the table, there does not seem to be any consistent relationship between the size of the establishment and the magnitude of the EDP installation that it will acquire. For example, while it is true that more large EDP installations are accounted for by establishments with 1,500 or more employees than by either the medium or small establishments, the number of large computers installed by medium and small establishments taken together outnumbers those of the large establishments. Or again, while it is true that the establishments with from 250-1,500 employees install proportionally more medium-scale computers than do small establishments, the large organizations account for more medium-size installations than do the medium-size establishments.

It should be remembered that the size of the establishment where the computer is located does not always reflect the size of the organization. As an example, quite a modest sized establishment may house a large computer because it represents the head office of a large decentralized enterprise where the computer is being used to integrate the paper work of the whole concern. Another example would be commercial service bureaus which may have computers of any size, but are always small establishments. Two of the 9 large computers are located in such service bureaus.

The tenuousness of the relationship between the size of the user and the magnitude of the hardware that is acquired is illustrated even more clearly when the size of the organization as a whole is substituted for the size of the particular establishment where the computer is located.

Table 5 - Distribution of Computers, by Size of Organization, and by Size of Computer, in Canada, January 1, 1960

Size of Organization (Number of Employees)	Number of Organizations in Size Category	Large	Medium/ Large	Medium/ Small	Small	Total
Small Up to 750...	15	-	4	4	8	16
Medium 751-4,500...	34	5	11	18	9	43
Large 4,501 and over.	20	4	5	18	3	30
	69	9	20	40	20	89

It may well be that the influence of the size of the establishment or the size of the organization on the magnitude of the hardware acquired is secondary to the nature of the enterprise and to the sort of work for which the computer is being used. There is some indication that some of the smaller computers used by the large and medium establishments and organizations are second or additional computers allocated to particular jobs. For example, a large organization may install a large- or medium-size computer to centralize and integrate its office routine--payroll, inventory, customer billing, etc.--and at the same time acquire a small computer to carry out scientific or engineering computation in a particular establishment or department.

Chapter III

Computer Utilization

The 89 computers in Canada at January 1, 1960 were being operated by the establishments where they were located for a total of 4,519 hours per week. Twenty-nine of these computers were also being operated for or by outside users for an additional 335 hours per week. The total average weekly usage of computers in Canada at the beginning of January 1960 was 4,854 hours, just about an average of 55 hours per computer installation per week.

Computer applications ranged all the way from integrated data processing(1) in some insurance companies to the calculation of a least cost feed formula for hogs performed on a 'one-shot' basis by a commercial service bureau for one of its customers.

To simplify the picture of utilization, respondents were asked to indicate the proportion of computer time devoted to commercial or business applications as compared to applications that can best be described as scientific or engineering. By and large, classification into these two broad categories of applications was done simply by accepting the respondents' own interpretation of the nature of the application. In a minority of cases, however, particular applications included elements of both scientific computation and business-type data processing. In such cases assignment was made rather arbitrarily on the basis of function rather than subject matter.

Table 6 - Computer Utilization by Size of Computer, in Canada, January 1, 1960

Magnitude of Computer	Business Applications (hours per week)	Scientific Applications (hours per week)	Total Utilization (hours per week)
Small.....	10	586	596
Medium.....	1,710	1,483	3,193
Large.....	602	128	730
	2,322	2,197	4,519

(1) An application concerning all the accounting, posting, and up-dating processing involved in the administration of insurance policies, including customer billing, and the production of statistical information required for periodic statements and reports.

The findings of this table suggest that work performed by computers was divided just about equally between commercial data processing applications (51 per cent) and scientific computations (49 per cent). Probably a more realistic reflection of the actual situation, however, would be derived from weighting the comparative capacity of the small:medium:large EDP installations as 1:10:100. In that case commercial applications were found to account for almost three-quarters (73 per cent) of computer utilization, while scientific computation accounted for only one-quarter (27 per cent). This is because, by and large, the large capacity computers were used more for commercial data processing while the smaller computers were used primarily for engineering and scientific calculations. While this may represent a realistic apportionment of the capacity of electronic digital computers as between business and engineering work, it understates the amount of scientific and engineering work being handled by computers since a large proportion of such work is carried out on analogue computers which were not covered in this survey.

The extent of computer utilization by the various industry groups followed more or less closely what might have been predicted once the distribution of computers among such groups is known.

Table 7 - Computer Utilization by Major Industry Group, in Canada, January 1, 1960

Industry Group	Business Applications (hours per week)	Scientific Applications (hours per week)	Total Utilization (hours per week)
Manufacturing	924	518	1,442
Community and Business Services	103	845	948
Finance, Insurance	705	25	730
Public Administration, Defence	112	593	705
Transportation	260	134	394
Utilities	173	82	255
Trade	45	-	45
	2,322	2,197	4,519

The only difference from the rank order in Table 3 above is that the Public Administration and Finance, Insurance groups have exchanged the third and fourth positions. Manufacturing and Finance, Insurance were found to be the two largest users of computers for business data processing, accounting for well over two-thirds of the total commercial data processing. Community and Business Services and Public Administration were the two largest users of computers for scientific applications, accounting for about two-thirds of total scientific and engineering computer utilization.

Should weighting for size of computer be introduced, of course those industry groups in which the larger computers were concentrated and which devoted less time to scientific applications such as Finance and Insurance, Transportation and Utilities would move up in the rank order; those groups for which a high proportion of applications were in the nature of scientific and engineering computations and were usually carried out on smaller computers such as Community and Business Services, and Public Administration would move down in rank order; and Manufacturing whose range of computers and commercial/scientific application 'split' was more evenly balanced would occupy an intermediate position in the rank order.

There were many cases where a computer was used only for commercial data processing or for scientific computations. However, a common pattern was to have the computer time split on a 90:10, 80:20, 70:30, or 60:40 basis between commercial and scientific applications.

Table 8 - Business and Scientific Computer Utilization, by Type of Computer, in Canada, January 1, 1960

Type of Computer	Business Applications						Scientific Applications					Total
	100%	90%	80%	70%	60%	50%/50%	100%	90%	80%	70%	60%	
Large...	3	3	-	1	1	-	-	1	-	-	-	9
Medium..	26	2	-	3	2	2	17	6	-	1	1	60
Small...	-	-	-	-	-	-	17	2	1	-	-	20
	29	5	-	4	3	2	34	9	1	1	1	89

The scientific and engineering applications performed on computers were found to be so numerous and diffuse as to make any sort of statistical analysis and presentation inadvisable. While some techniques such as regression analysis, data reduction, curve fitting, etc., were found to recur frequently, the great majority of scientific and engineering studies were found to be specific to the industry or organization in which they occurred. In addition, many of the scientific or engineering computations which had been carried out were described as 'one-shot' studies.

A partial list of scientific and engineering applications, illustrating this wide range of subject matter is included below.

List of Scientific and Engineering Applications

Systems simulation
Flight test data reduction
Power transformer design
Flight dynamics analysis
Aircraft engine performance analysis
Reservoir engineering
Refinery simulation
Equipment design
Highway and bridge design
Optical and photographic equipment design
Stability analysis and power flow studies
Gibson diagram analysis
Cracking and power forming predictions
Operations research
Atmospheric meteorological studies
Thermodynamic studies
Acoustical studies
Linear programming
Electrical power generation studies
Research on information theory
Analysis of electroencephalographs
Stress analysis
Nuclear power reactor design
Motor generator design
Aircraft performance analysis
Single track (railway) capacity analysis
Seismographic analysis
Hydrodynamics and hydraulics simulation and analysis
Plant systems design
Magnetometer data reduction
Calculation of systems transmission losses
Penstock calculations
Stress boundary value problems
Economic analysis and forecasting
Traffic engineering
Gas engineering
Engineering surveys
Vibration studies
Earthwork design
Electricity load flow
Research on circuit theory
Research on artificial intelligence

In addition to the applications included in this list there was a wide variety of analytical studies carried out in the fields of physics, chemistry, biology and medicine, astronomy and mathematics, civil, electrical, mechanical, chemical and aeronautical engineering, agriculture, economics and geology

The commercial and business applications, on the other hand, appeared to be general or periodic and lent themselves somewhat better to analysis. This is evident in the following table.

When this table was weighted to take the varying magnitudes of the installations into account, it was found to have very little effect upon the rank of the applications. Traffic and Transportation moved up from eighth to third position; Inventory Control dropped from third to fifth position; and Production Control dropped from fifth to eighth position.

Table 9 - Commercial Computer Applications, by Major Industry Group, in Canada, January 1, 1960

Application (Hours Per Week)	Hours Per Week							
	Manufacturing	Finance, Insurance(1)	Transportation	Utilities	Public Administration, Defence	Community Service	Trade	Total
Accounts Receivable, Accounts Payable, Customer Billing	182	284	-	138	16	-	23	643
Payroll	177	62	149	-	27	2	2	419
Inventory Control	210	-	29	-	36	6	13	294
Budget and Cost Accounting	82	139	-	-	4	8	-	233
Production Control	159	-	2	-	-	1	-	162
Financial Analysis and Statistics	35	98	-	-	19	4	2	158
Sales Analysis	66	27	1	-	1	10	5	110
Traffic and Transportation	3	-	74	-	-	-	-	77
Program Testing and Development	3	12	-	4	4	5	-	28
Quality Control	-	-	-	-	-	5	-	5
Miscellaneous	7	83	5	31	5	62	-	193
	924	705	260	173	112	103	45	2,322

(1) Finance, Insurance. Some of the computer applications carried out by insurance companies such as customer (premium) billing, payroll, and program testing and development fitted the framework of analysis appropriate to the other respondents. However, the bulk of the insurance companies accounting and record maintenance applications were unique. This was especially true where an integrated approach to insurance processing had been adopted.

The heavy capital or monthly rental investment in EDP equipment, especially in the case of the million dollar plus large-scale computers, has begun to introduce a certain amount of multiple shift working into the traditional nine-to-five world of the office.(1)

Table 10 - Shift Working by Size of Computer, in Canada, January 1, 1960

Pattern of Shift Working	Small	Medium	Large	Total
Day Shift Only	10	18	3	31
Day Shift Plus Regular Overtime	10	30	1	41
Two or More Regular Shifts	-	12	5	17
	20	60	9	89

As would be expected, the greater proportion of the multiple shift working occurred in those industry groups in which the larger installations are clustered.

Table 11 - Shift Working, by Major Industry Group, in Canada, January 1, 1960

Industry Group	Single Shift Only	Day Shift Plus Regular Overtime	Two or More Regular Shifts	Total
Manufacturing	11	13	6	30
Community and Business Services	11	14	1	26
Public Administration, Defence	3	8	2	13
Finance, Insurance	3	5	4	12
Transportation	2	-	3	5
Utilities	-	1	1	2
Trade	1	-	-	1
	31	41	17	89

(1) This is not to suggest that additional shift operations do not involve additional costs in terms of depreciation or increased monthly rentals and in salary costs.

Of the 89 computers, 2 were utilized less than 5 days a week; the great majority (63) were operated on a 5-day week; 3 installations were run on a 5½-day week; 14 were operated 6 days a week; and 7 were operated either 6½ days or 7 days a week. In one or two of the largest installations, 'around-the-clock' working on a 7-day week basis had been instituted, requiring four complete personnel shifts.

Included in the over-all total of 4,854 (average) computer hours utilized per week were the applications carried out for customers by commercial data processing installations (service bureaus) or on private installations which rent out excess capacity on their computers to other organizations. This may be important insofar as it may mean that smaller organizations which cannot justify computer installations of their own may obtain access to appropriate blocks of computer time. They may prepare the input, program the instructions, and even operate the computer themselves or they may have any or all of these operations performed for them by the staff of the service bureau. Depending upon the extent of such utilization, the impact of EDP may extend beyond the bounds of organizations equipped with EDP.

Sixty of the 89 computer installations were found either to require the use of all their computers' available time or at least did not rent out any proportion of their computers' free time to outside organizations. Twenty-nine installations rented out time to a total of 126 outside users for a total of 335 hours (average) per week. Although the total number of outside users appears impressive,(1) the proportion that such utilization bears to the extent of over-all computer utilization is small (7 per cent).

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(1) It has been observed that this figure may in fact be inflated because a single outside user may utilize several different installations and hence be counted more than once in a survey of this type.

Chapter IV

Computer Personnel

Although it is not known how many jobs the 89 computers in Canada may have eliminated, the survey showed that EDP has created 1,216 full-time jobs that didn't exist before the introduction of EDP. EDP is also responsible for part of the work of an additional 646 people.

Table 12 - Electronic Data Processing Personnel, in Canada, January 1, 1960

Occupation	Male	Female	Total
Administrators.....	157	10	167
Project Planners(1).....	120	2	122
Programmers(2).....	309	48	357
Computer Operators(3).....	117	27	144
Computer Technicians(4).....	130	-	130
Other Full-Time EDP Personnel(5)...	96	200	296
Total Full-Time EDP Personnel....	929	287	1,216
Part-Time EDP Personnel(6).....	429	217	646
Total EDP Personnel.....	1,358	504	1,862

(1) Sometimes referred to simply as planners.
(2) Includes programmers, coders, and programmer/operators in the case of some of the smaller installations.
(3) Includes console operators and tape handlers.
(4) Twenty-six computer technicians are employees of the establishments where the computers are located (including 14 employees of the computer manufacturers at the manufacturers' own installations); 104 computer technicians are employees of the computer manufacturers and distributors servicing customer installations on a contractual basis. One large installation employs 3 employees of its own as computer technician trainees in addition to a staff of 8 resident technicians who are employees of the computer manufacturer.
(5) Includes peripheral equipment operators, data typists, tape librarians, computer centre receptionists, and key punch operators and verifiers whose full-time work is preparing input for the computer.
(6) Includes both machine operators and clerks whose time is divided between the work of the EDP installation and other clerical or mechanical tabulating duties; also includes company officers, professionals, engineers and scientists, university faculty and students who spend part of their time in work related to the programming, operating, and input/output activities of computers.

One of the most striking characteristics of EDP staffing illustrated by this table is the high ratio of the senior planning occupations to the more junior operator occupations. Of the 1,216 full-time jobs, 646 (53 per cent) are those of administrators, project planners and programmers.

From this table it can also be seen that despite the current stereotype of the svelte blonde seated at the control console of 'the giant electronic brain', more than three out of four of the new full-time EDP jobs were being filled by males. This differential is even more pronounced for the planning level jobs where 586 (90 per cent) of the 646 administrators, project planners and programmers were found to be men. In the case of computer operators, the ratio was also high--4:1. It is only at the junior level EDP jobs such as datatypists, tape librarians, receptionists, full- and part-time clerical assistants that the female complement of the EDP staffs begins to be filled out. One of the reasons for this appears to be the risk of having marriage or pregnancy endanger the substantial investment made in formal and on-the-job training in these new occupations.

The personnel complement of an individual EDP installation will, of course, vary with the size of the installation and with the sort of application being performed. A hypothetical staff of a large computer installation in the head office of a large manufacturing firm or insurance company might typically include:(1) 15 administrators and planners; 19 programmers; 8 computer operators; 8 computer technicians; and a staff of perhaps 20 peripheral equipment operators, datatypists, tape librarians, receptionists and full-time clerical personnel. The number of computer operators and maintenance technicians reflects the multiple shift pattern of operation usually encountered in the large EDP installations.

A hypothetical staff of a medium-sized EDP installation in a business or manufacturing establishment or in a government agency might include:(1) 3 administrators and planners; 3 programmers; 1 computer operator; 1 computer technician, full-time or part-time; and a staff of 1 or 2 auxilliary personnel.

A hypothetical staff of a small-sized EDP installation might include:(1) 1 part-time administrator and planner; 1 programmer/operator; the half-time services of an additional employee; and the part-time service of a technician whose work includes the maintenance of at least one other installation.

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(1) Averages compiled from the complements of actual installations. These averages are representative insofar as they reflect the typical configuration of actual installations. Averages were chosen in preference to ranges because a few atypical cases broadened the ranges beyond meaningful limits.

The 1,216 full-time EDP jobs reported through the survey may underestimate the number of people actually engaged in such work in Canada at January 1, 1960, for at least two reasons: first, a substantial proportion of the 126 organizations who do not have computers of their own but who use computer time on a rental basis employ planners, programmers, and may even have their own operators. Second, there were a substantial number of Canadian organizations scheduled to receive EDP equipment in 1960-61 which already had built up substantial staffs of planners and programmers which are not included in this survey.

Chapter V

Potential Employment Impact

No attempt was made through this mailed survey to assess the actual or potential employment impact of EDP. The complexity of this feature of EDP rendered a mail inquiry respecting it inadequate. This, however, will be one of the objectives of further research.

It may be of some interest to note, however, that total employment in the establishments with computers as of January 1960 was approximately 177,000 people. As might be expected a considerable proportion of this total was office employment, about 42 per cent.

Table 13 - Geographical Distribution of Employment in Establishments Utilizing Computers, January 1, 1960

Region	Total Employment	Office Employment
Atlantic	448	268
Quebec	74,390	27,879
Ontario	84,289	37,234
Prairie	9,884	5,059
Pacific	7,915	3,766
	176,926	74,206

Table 14 - Distribution of Employment in Establishments Utilizing Computers, by Major Industry Group, January 1, 1960

Industry	Total Employment	Office Employment
Manufacturing	82,047	26,380
Transportation	34,175	8,438
Community and Business Services	32,995	17,915
Public Administration, Defence	11,027	8,679
Finance, Insurance	8,710	8,065
Utilities	7,697	4,586
Trade	275	143
	176,926	74,206

Quite clearly, the figure of total employment in establishments with computers cannot be taken as the employment area affected by EDP. This figure will include skilled, semi-skilled and unskilled plant workers whose employment is much more likely to be affected by technological change in the factory than by EDP.

Nor is the figure of 74,206 office workers employed in establishments utilizing computers an acceptable upper parameter of the number of jobs that may be affected, in varying degree, by electronic data processing. This figure, if accepted uncritically, would almost certainly exaggerate the area of actual or potential impact, because, as a measure of office or salaried employment rather than a measure of clerical employment, it includes large groups of white collar workers--sales, professionals, technicians, executives and administrators, etc.--whose jobs would be affected only slightly, if at all, by EDP. Further, it should be borne in mind that the phrase 'jobs affected by EDP' should not be confused with the concept of 'jobs eliminated by EDP'. The use of the term 'jobs affected' refers to all those jobs which may undergo change as a result of the introduction of electronic data processing. This will include a smaller number of jobs which may be completely eliminated by EDP and a larger number of jobs whose content may be modified or which may be combined with other jobs, resulting in transfers of some employees to unaffected areas, the need for training and retraining to equip present employees to handle the jobs in their new form, and so on.

In considering the potential occupational and employment impact of EDP, it is important to realize that there will be a great deal of variation from one case to the next. The reason for this is that so much will depend on the size of the computer that is acquired and on the sort of work the computer is to be used for. In an insurance company with a large-scale computer undertaking combined operations processing, for example, it is probably reasonably accurate to assume that the introduction of the computer is sooner or later going to affect the jobs of almost everyone in the organization to a greater or lesser extent. Much more commonly, however, the applications of a medium-sized computer may be confined to a single department or a combination of several departments in an establishment and may only affect the work of the personnel in those particular departments. In the extreme case of a large establishment with a small computer located in an engineering or design department, EDP may more appropriately be viewed simply as an additional engineering tool and may be expected to affect the work--and certainly not the employment--of only a small nucleus of personnel.

But, on the other hand, the use of office employment in establishments with EDP as a measure of potential employment impact is unsatisfactory in the opposite direction insofar as it does not include certain areas that may be affected. Consider, for example, the head office establishment at which data processing for a large number of branches, warehouses, etc., has been centralized. In such a case, there can be little doubt that larger areas of office employment may be affected than could be expected to show up under the concept of the establishment where the computer is physically located. Or in the case of some of the small- and medium-sized customers of the commercial service bureaus there can be little doubt that the farming out of work of this kind has effects--likely including clerical employment effects--on the staff of the organizations purchasing such services.

APPENDIX A

Distribution of Computers by Type of Industry, and by Size of Computer, in Canada, January 1, 1960

Type of Industry	No. of Organizations	No. of Establishments	Type of Computer			
			Large	Medium	Small	Total
Manufacturing						
Aircraft	3	3	-	5	-	5
Automobile & Farm Implements	3	4	-	5	-	5
Electrical Equipment	2	3	-	4	-	4
Steel & Steel Products	2	3	-	2	1	3
Chemical	2	3	-	3	-	3
Petroleum	2	3	1	2	-	3
Electronic Equipment	2	2	-	2	-	2
Pharmaceutical	1	1	-	1	-	1
Heavy Machinery	1	1	-	-	1	1
Miscellaneous	3	3	-	2	1	3
Community & Business Services						
Engineering Consultants & Computer Service Bureaus	9	11	2	6	3	11
Universities	14	14	-	8	6	14
Hospitals	1	1	-	-	1	1
Public Administration, Defence						
Armed Forces & Defence Establishments	4	5	1	2	2	5
Federal Government Departments & Agencies	2	3	-	3	-	3
Provincial Departments of Highways	2	2	-	1	1	2
Other Provincial Departments & Agencies	3	3	-	1	2	3
Finance, Insurance						
Insurance	7	7	3	7	1	11
Loan Companies	1	1	-	1	-	1
Transportation						
Railway	2	2	1	2	-	3
Airline	1	1	-	1	-	1
Pipeline	1	1	-	-	1	1
Utilities						
Electric Power	2	2	1	1	-	2
Trade						
Wholesale Grocery	1	1	-	1	-	1
	71*	80	9	60	20	89

* Two multi-establishment, multi-computer organizations are counted twice because they are each engaged in two different types of industrial production or service.

APPENDIX B

Alphabetic List of Computer Users Co-Operating in Survey

Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ontario.
Atomic Energy of Canada, Ltd., Chalk River, Ontario.
British Columbia Electric Co., Ltd., Vancouver, B.C.
British Columbia Forest Service, Victoria, B.C.
Burroughs Adding Machine of Canada, Ltd., Ottawa, Ontario.
Canadair Ltd., Montreal, Quebec.
Canadian Armament Research and Development Establishment, Quebec, P.Q.
Canadian Army, No. 1 Army Pay Ledger Unit, Ottawa, Ontario.
Canadian General Electric Co., Ltd., Lamp Department, Toronto, Ontario.
Canadian General Electric Co., Ltd., Peterborough, Ontario.
Canadian National Railways, Montreal, P.Q.
Canadian Pacific Railway Co., Montreal, P.Q.
Canadian Industries Ltd., Montreal, P.Q.
Canadian Industries Ltd., McMasterville, P.Q.
Canadian Pratt and Whitney Aircraft Company Ltd., Longueuil, P.Q.
Computing Devices of Canada, Ltd., Ottawa, Ontario.
Computing Devices of Canada, Ltd., Toronto, Ontario.
C.E.S. Computer Service Centre, Calgary, Alberta.
Confederation Life Association, Toronto, Ontario.
Crown Life Insurance Co., Toronto, Ontario.
Dominion Engineering Co., Ltd., Lachine, P.Q.
DuPont of Canada, Ltd., Montreal, P.Q.
Enelco Ltd., Toronto, Ontario.
Ernst Leitz (Canada) Ltd., Midland, Ontario.
Forestal, Forestry and Engineering International Ltd., Vancouver, B.C.
Ford Motor Company of Canada, Oakville, Ontario.
Ford Motor Company of Canada, Windsor, Ontario.
General Motors of Canada, Ltd., Oshawa, Ontario.
The Great-West Life Assurance Co., Winnipeg, Manitoba.
Hydro Electric Power Commission of Ontario, Toronto, Ontario.
Imperial Oil Ltd., Toronto, Ontario.
Imperial Oil Ltd., Sarnia, Ontario.
Industrial Acceptance Corporation Ltd., Town of Mount Royal, P.Q.
International Business Machines Co., Ltd., Toronto, Ontario.
International Business Machines Co., Ltd., Montreal, P.Q.
Interprovincial Pipe Line Co., Edmonton, Alberta.
K.C.S. Limited, Toronto, Ontario.
Laval University, Quebec, P.Q.
London Life Insurance Co., London, Ontario.
Manufacturers' Life Insurance Co., Toronto, Ontario.
Massey-Ferguson Ltd., Toronto, Ontario.
McGill University, Montreal, P.Q.
McMaster University, Hamilton, Ontario.
The Mutual Life Assurance Company of Canada, Waterloo, Ontario.

National Research Council, Ottawa, Ontario.
Northern Electric Co., Ltd., Montreal, P.Q.
Oil and Gas Conservation Board, Calgary, Alberta.
Ontario Agricultural College, Guelph, Ontario.
Ontario Department of Highways, Downsview, Ontario.
Ontario Workmen's Compensation Board, Toronto, Ontario.
Orenda Engines Ltd., Malton, Ontario.
The Oshawa Wholesale Ltd., Toronto, Ontario.
Pacific Naval Laboratory, Esquimalt, B.C.
Parke, Davis and Company, Brockville, Ontario.
Procter and Gamble Co., Canada. Ltd., Toronto, Ontario.
Prudential Insurance Company of America, Toronto, Ontario.
Remington Rand Ltd., Toronto, Ontario.
Royal Canadian Air Force, Rockcliffe, Ontario.
Royal Canadian Air Force, Clinton, Ontario.
Saskatchewan Department of Highways, Regina, Sask.
Shell Oil Company of Canada, Ltd., Montreal East, P.Q.
The Steel Company of Canada, Ltd., Hamilton, Ontario.
St. Mary's University, Halifax, N.S.
Stock, Keith and Associates, Regina, Sask.
Sun Life Assurance Company of Canada, Montreal, P.Q.
Trans Canada Air Lines, Montreal, P.Q.
United Shoe Machinery Company of Canada, Ltd., Montreal, P.Q.
University of Alberta, Edmonton, Alberta.
University of British Columbia, Vancouver, B.C.
University of Manitoba, Winnipeg, Manitoba.
Universite de Montreal, Montreal, P.Q.
University of New Brunswick, Fredericton, N.B.
University of Toronto, Toronto, Ontario.
University of Ottawa, Ottawa, Ontario.
University of Saskatchewan, Saskatoon, Sask.
University of Western Ontario, London, Ontario.
Winnipeg General Hospital, Winnipeg, Manitoba.

APPENDIX C

Alphabetic List of Computer Manufacturers and Distributors Co-Operating in the Survey

Burroughs Adding Machine of Canada, Ltd., Ottawa, Ontario.
Computing Devices of Canada Ltd., Ottawa, Ontario.
International Business Machines Co., Ltd., Toronto, Ontario.
The McBee Co., Ltd., Toronto, Ontario.
Remington Rand Ltd., Toronto, Ontario.

Appendix D

DEPARTMENT OF LABOUR
Economics and Research Branch

IN CONFIDENCE

CANADA

SURVEY OF THE CURRENT STATUS OF ELECTRONIC DATA PROCESSING IN CANADA

⇨ Please report as at January 1, 1960

Name of firm, organization or institution

Address

Nature of Business
(principal product(s) and/or service(s))

INFORMATION ON EMPLOYMENT

Total number of employees on the payroll of firm, organization or institution

M	F	Total

Number of clerical employees on the payroll of firm, organization or institution (include secretarial, public contact, record keeping, accounting, machine operation and clerical supervision)

M	F	Total

Total number of employees on the payroll of the establishment where the computer is located

M	F	Total

Number of clerical employees (see above) on the payroll of the establishment where the computer is located

M	F	Total

DESCRIPTION OF EQUIPMENT

Computer manufacturer — Model

Date installed — ☐ leased — ☐ owned

List peripheral equipment used in connection with computer

COMPUTER UTILIZATION

List principal computer applications

Commercial or business data processing	% time	Scientific or engineering applications	% time
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	

(Use reverse side to list additional applications)

LER 80-02

Continued reverse side ➡

Average number of hours per week computer is used by your organization [ ]

N.B. Include production, program testing, and unscheduled down time. Exclude scheduled maintenance and work for or by outside users.

Number of other firms or organizations using computer [ ]

Average number of hours per week [ ]

Average number of days per week computer is in use [ ]

Is computer operated on regular day shift [ ] day shift plus overtime [ ] two or more regular shifts [ ]

COMPUTER PERSONNEL

Number of personnel employed full time primarily as:

	Male	Female	Total
Administrators or supervisors.....			
Project planners or systems analysts.....			
Programmers.....			
Computer operators.....			
Other full time computer personnel 1.			
2.			
3.			
4.			
5.			
(Please list job titles) TOTAL			

Approximately how many additional personnel are involved, part time, in computer work

M	F	Total

Please describe types of personnel involved:

How many computer technicians are required to service your installation [ ]

N.B. Please calculate in terms of full time positions required to service your installation

Are they your own employees [ ] or employees of the computer manufacturer [ ]

Date.....

Signature.....

Canada. Interdepartmental
Skilled Manpower Training
Research Committee
Report